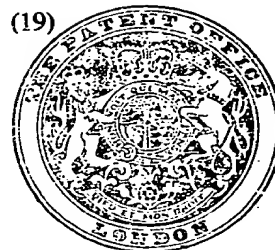


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(19)



(54) METHOD OF AND APPARATUS FOR THE HANDLING  
OF SHEET MATERIAL

(71) We, TIMSONS LIMITED, a British Company of Perfecta Works, Bath Road, Kettering, Northants, NN16 9NG, do hereby declare the invention for which we pray

5 that a patent may be granted to us and the method by which it is to be performed to be particularly described in and by the following statement:

This invention relates to a method of, and apparatus for, the handling of sheet material. The invention has been developed for the handling of sheet material in the form of paper in respect of which the invention will be described. However, the

10 invention is not limited to the handling of paper.

In the printing and/or binding industry it is often necessary to turn over an element of sheet material and to combine this

20 element with another element of sheet material. The element will normally comprise a number of single sheets of paper or a number of superimposed signatures, each signature comprising a plurality of

25 folded sheets of paper.

It is an object of a first aspect of the invention to provide an apparatus, hereinafter referred to as an apparatus of the type specified, for turning over an element

30 of sheet material and then combining this element with a further element of sheet material.

According to this aspect of the invention we provide an apparatus of the type specified comprising a first conveying means for conveying a stream of elements of sheet material along a path to a rotary member, said rotary member being rotatable about a horizontal axis arranged trans-

40 versely with respect to the path and being provided with one or more receiving means which are presented to said path upon rotation of the member to receive the leading edge portions of certain of the elements,

45 hereinafter referred to as the first series

of elements, of the stream and to divert said first series of elements onto a second conveying means while turning over said first series of elements, said rotary member being arranged upon rotation to

50 allow the other elements, hereinafter referred to as the second series of elements, receiving means to pass onto a third conveying means, and a combining station to

55 which said second and third conveying means convey said elements and at which said elements are combined in pairs, each pair comprising an element of the first series and an element of the second series.

In one arrangement the path of the stream of elements is horizontal and the third conveying means is a continuation of this horizontal path, the second conveying means being positioned below the third conveying means and being inclined up-

60 wardly towards said combining station so that the elements can be combined in pairs consisting of an element of the second series placed on top of an element of the first series.

70

The apparatus described above is particularly suitable for use in the printing and/or binding industry in the manufacture of a double block for a book or book section using the 2-up coming and

75 going mode of collation. Each element will be in the form of half a block and will comprise the first half of one book or book section and the second half of another book or book section. By assembling such

80 an element with a similar element which has been turned over, one can obtain a double-block containing the pages of two complete books or book sections. In the case of a double-block containing the pages of two complete books this block is then

85 bound and subsequently divided into two books. If the double-block contains the pages of two book sections the block can be combined with other sections of the

90

book printed using the 2-up coming and going method of collation to produce a larger double-block which can then be bound and divided into two complete books.

5 The receiving means may comprise one or more channels into which the leading edge portions of the first series of elements are received. The or each channel may be provided by a plurality of aligned L-shaped  
10 fingers secured to the rotary member so that one limb of each finger forms part of the base of a channel and the other limb of the finger forms part of one of the sides of the channel, the other side of the channel  
15 being provided by part of the rotary member. Preferably the or each channel converges from its mouth towards its base thus facilitating the entry of the leading edge portions of the elements into the  
20 channel as the elements are delivered to the receiving means by the first conveying means.

Preferably the apparatus includes a restraining means which keeps the leading edge portions of the elements in the receiving means while the rotary member travels through an arc of approximately 180°. The restraining means may comprise an arcuate guide spaced from the rotary  
30 member and arranged to be engaged by the trailing edge of each element until the element has been turned over by the rotation of the rotary member when the element will fall away from the guide and  
35 out of the receiving means onto the second conveying means.

It is an object of another aspect of the invention to provide a method, hereinafter referred to as a method of the type  
40 specified, for turning over an element of element with a further element of sheet material.

According to this aspect of the invention we provide a method of the type  
45 specified comprising conveying a stream of elements of sheet material on a first conveying means along a path to a rotary member rotatable about a horizontal axis arranged transversely with respect of the  
50 path diverting certain of the elements, hereinafter referred to as the first series of elements of the stream onto a second conveying means while turning over said first series of elements about said axis by  
55 causing the leading edge portions of said first series of elements to travel through an arc of approximately 180° about said axis while allowing the trailing edge portion of the elements to fall over said leading edge  
60 portions, allowing the other elements, hereinafter referred to as the second series of elements, of the stream to pass said rotary member and to travel undiverted to a third conveying mean, and bringing together  
65 in pairs said first and second series of

elements carried by said second and third conveying means, each pair comprising an element of the first series and an element of the second series.

The above method is particularly  
70 applicable to the manufacture of double-blocks for books or book sections using the 2-up coming and going mode of collation.

The invention will now be described in detail, by way of example, with reference to  
75 the accompanying diagrammatic drawings wherein:—

FIGURE 1 is a view in side elevation showing part of an apparatus used in the manufacture of a double-book block using  
80 the 2-up coming and going mode of collation;

FIGURE 2 is a fragmentary view of the apparatus in plan.

Referring to the drawing, the apparatus  
85 comprises a first conveying means indicated generally at 10 comprising laterally spaced endless belts 10a guided on idler pulleys 10b and driven pulleys 10c, two only of such belts being shown for convenience.  
90 Associated with the first conveying means are one or more rollers 11 disposed in respective spaces between the belts 10a, a single roller being shown for convenience. The roller 11 is rotatable about a horizontal  
95 axis 12 in the direction of the arrow A. The roller 11 is provided with receiving means in the form of two open-ended channels 13 and 14 at diametrically opposite  
100 positions. Each channel is formed by a series of aligned L-shaped fingers which are positioned at longitudinally spaced locations on the roller, thus each finger as a limb 16  
105 which forms part of the base of the channel and a limb 17 which forms part of one of the sides of the channel. The other side of the channel is provided by the adjacent surface of the roller. It will be noted that the channels converge towards their bases  
110 16 due to the divergence of the limbs 17 from the surface of the roller.

An arcuate guide 19 is spaced from the roller 11 and constitutes a restraining means, as will be described, while the channels 13 and 14 constitute receiving  
115 means for half-blocks carried by the conveying means 10.

The apparatus includes a second conveying means 20 which receives half-blocks which have been rotated about the axis 12  
120 of the roller 11 through an arc of approximately 180°. This second conveying means carries the half-blocks to a combining station 21 at which position the half-blocks carried by the conveying means 20 are combined with further half-blocks which have  
125 passed the roller 11 and been transferred to a third conveying means 22 without entering one of the channels 13 and 14, and have been conveyed to the combining station by 130

such third conveying means 22.

The conveying means 20 comprises laterally spaced endless belts 20a guided by pulleys 20b, one at least of which is driven, and the conveying means 22 comprises laterally spaced endless belts 22a guided by pulleys 22b, 22c, at least one of which is driven.

In the vicinity of the combining station the horizontal run of each belt 20a is below the horizontal run of each belt 22a. The path lengths along which the respectively conveyed half-blocks travel and the speed of the belts are contrived to ensure super position of half-blocks from belts 22a on half- on belts 20a.

Associated with the guide 19 is a movable gate entry section 23 which comprises upper and lower arms 23a, 23b pivoted about respective horizontal axes 24a, 24b and linked or combined in some suitable manner to pivot in unison.

The above apparatus functions as follows. Half-blocks 25 are fed towards the roller 11 by the belts 10a which are driven at a speed somewhat higher than the peripheral speed of roller 11. The roller 11 rotates in the direction of the arrow A and delivery of half-blocks 25 is synchronised with the angular position of roller 11 in a manner such that when alternate blocks reach the position indicated at 26 these alternate half-blocks are received in one of the channels 13 or 14. The arms 23a, 23b are are gravity biased to their lower positions, as seen in full lines, and since the limbs 17 of the channels 13, 14 constrain the half-blocks to follow an arcuate path concentric with the roller 11 the undersides of arms 23a are never engaged by the half-blocks and both arms 23a, 23b remain in their lower positions. Rotation of the drum 11 continues and these half-blocks are rotated on the drum 11 about the axis 12 through an arc of approximately 180° as described above. During this rotation the half-blocks are maintained in the channel 13 or 14 by the guide 19 until the half-blocks reach the position indicated at 27 when the half-blocks are free to fall from the channel onto the second conveying means 20.

It will be appreciated that when the half-blocks fall onto the conveying means 20 they will have been turned over about the axis 12 compared with their orientation when travelling on the first conveying means 10.

The half-blocks then travel on the second conveying means 20 to the combining station 21.

Those alternate half-blocks which do not enter the channel 13 or 14 engage the undersides of arms 23a and deflect both arms 23a, 23b to their upper positions as shown in broken lines. The lower arms 23b act as

bridges between belts 10a and 22a (although in many cases the half-blocks would have sufficient stiffness to undergo reliable transfer from belts 10a to 22a independently of arms 23b).

The drawing shows half-blocks 28 and 29 approaching the combining station 21 on the conveying means 20 and 22 respectively. These two half-blocks will be combined at the combining station to form a double-book block consisting of the half-block 29 placed on top of the half-block 28. A previously formed double-book block is shown to the right of the combining station at 30, 31.

Although in the above arrangement the arms 23a and 23b are described as being deflected to their upper positions by contact with the half-blocks, it will be appreciated that the deflection of the arms could be achieved by some means, such as for example a cam, whose operation is synchronised with the rotation of the drum 11 so as to deflect the arms at the appropriate moment.

The invention thus provides a method and apparatus for turning over a sheet material element and then combining this element with a further element. As indicated above the invention is particularly applicable to the manufacture of double-book blocks using the 2-up coming and going mode of collation.

#### WHAT WE CLAIM IS:—

1) An apparatus of the type specified comprising a first conveying means for conveying a stream of elements of sheet material along a path to a rotary member, said rotary member being rotatable about a horizontal axis arranged transversely with respect of the path and being provided with one or more receiving means which are presented to said path upon rotation of said member about said axis, said receiving means being arranged upon rotation of the member to receive the leading edge portions of certain of the elements, hereinafter referred to as the first series of elements, of the stream and to divert said first series of elements onto a second conveying means while turning over said first series of elements, said rotary member being arranged upon rotation to allow the other elements, hereinafter referred to as the second series of elements, of the stream which do not enter the receiving means to pass onto a third conveying means, and a combining station to which said second and third conveying means convey said elements and at which said elements are combined in pairs, each pair comprising an element of the first series and an element of the second series.

2) An apparatus according to claim 1 in which the receiving means comprises one

or more channels into which the leading edge portions of the first series of elements are received.

3) An apparatus according to claim 2 in which the or each channel is provided by a plurality of aligned L-shaped fingers secured to the rotary member so that one limb of each finger forms part of the base of a channel and the other limb of the finger forms part of one of the sides of the channel, the other side of the channel being provided by part of the rotary member.

4) An apparatus according to claim 2 or claim 3 in which the or each channel converges from its mouth towards its base thus facilitating the entry of the leading edge portions of the elements into the channel as the elements are delivered to the receiving means by the first conveying means.

5) An apparatus according to any one of claims 1 to 4 in which a restraining means is provided for keeping the leading edge portions of the elements in the receiving means while the rotary member travels through the arc of approximately  $180^\circ$ .

6) An apparatus according to claim 5 in which the restraining means comprises an arcuate guide spaced from the rotary member and arranged to be engaged by the trailing edge of each element until the element has been turned over by the rotation of the rotary member when the element will fall from the guide and out of the receiving means onto the second conveying means.

7) An apparatus according to any one of claims 1 to 6 in which there is provided between the rotary member and the third conveyor means a movable gate section which is arranged to be deflected in order to allow said second series of elements to pass on to the third conveying means.

8) An apparatus according to any one of claims 1 to 7 in which the path of the stream of elements is horizontal and the third conveying means and being inclined of this horizontal path, the second con-

veying means being positioned below the third conveying means and being inclined upwardly towards said combining station so that the elements can be combined in pairs consisting of an element of the second series placed on top of an element of the first series.

9) A method of the type specified comprising conveying a stream of elements of sheet material on a first conveying means along a path to a rotary member rotatable about a horizontal axis arranged transversely with respect to the path, diverting certain of the elements, hereinafter referred to as the first series of elements, of the stream onto a second conveying means while turning over said first series of elements about said axis by causing the leading edge portions of said first series of elements to travel through an arc of approximately  $180^\circ$  about said axis while allowing the trailing edge portions of the elements to fall over said leading edge portions, allowing the other elements, hereinafter referred to as the second series of elements, of the stream to pass said rotary member and to travel undiverted to a third conveying means, and bringing together in pairs said first and second series of elements carried by said second and third conveying means, each pair comprising an element of the first series and an element of the second series.

10) An apparatus of the type specified constructed and arranged substantially as hereinbefore described with reference to and as shown in the accompanying drawings.

11) A method of the type specified substantially as hereinbefore described with reference to the accompanying drawings.

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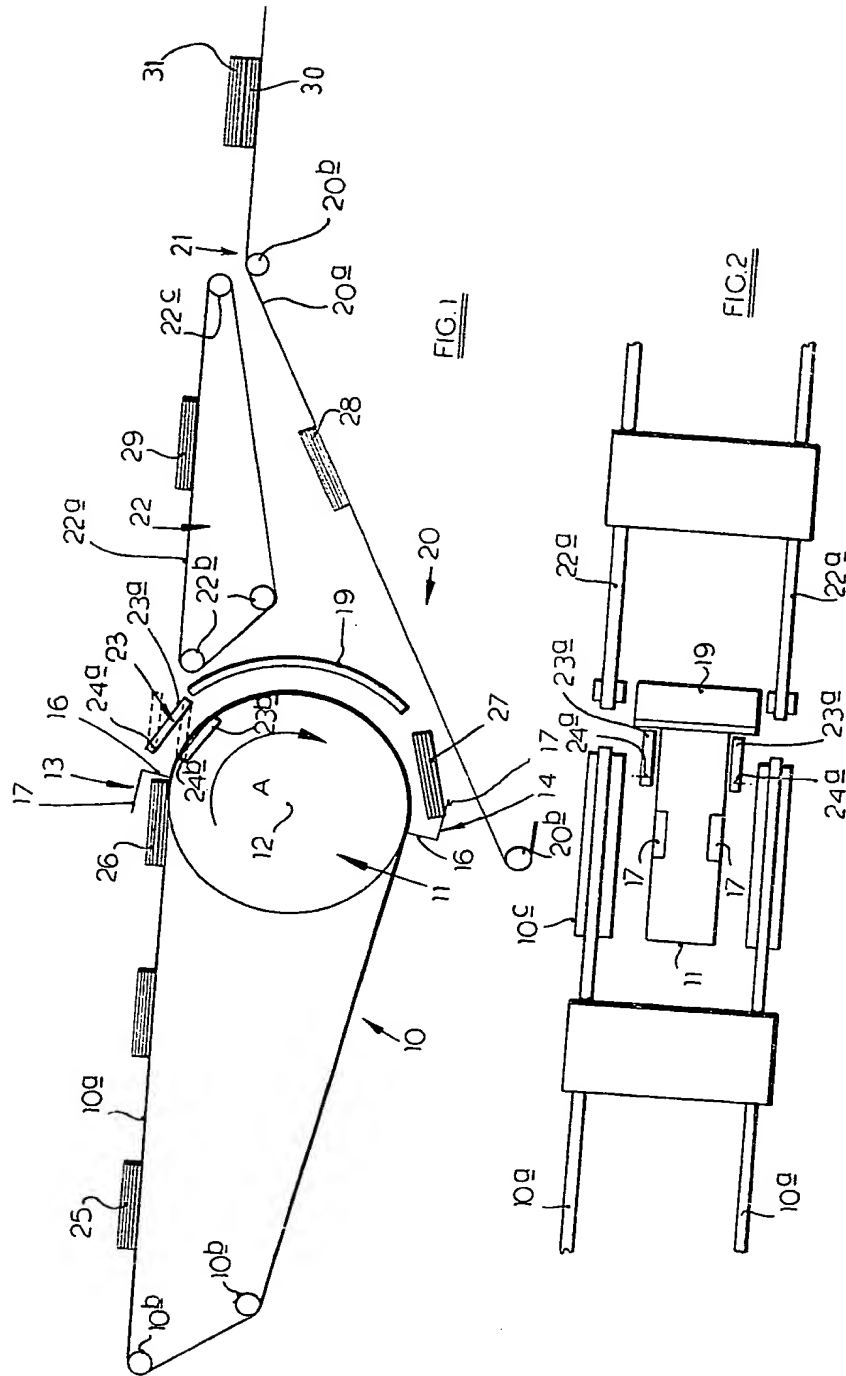
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